Executive Summary

On September 30, 2002, the City of Baltimore (City) entered into a Consent Decree (CD) with the United States Environmental Protection Agency (EPA), the State of Maryland Department of the Environment (MDE) and the Department of Justice (DOJ). The objective of Paragraph 9 of the CD is to complete a series of "Collection System Evaluation and Sewershed Plans". This Sewershed Study and Plan details the evaluation of the Low Level Sewershed.

The Low Level Sewershed is one of eight individual sewersheds located within the City of Baltimore. The study area for the Low Level Sewershed includes approximately 1,392,148 linear feet (LF) of gravity sewer ranging in size from 6- to 84-inches in diameter; approximately 8,500 public sector manholes and structures; 39,000 LF of force main and pressure sewer; 6 sewer siphons; two primary Interceptors (East and West); and three major pumping stations, the Eastern Avenue Pumping Station (122 mgd firm capacity), the Locust Point Pumping Station (1.8 mgd capacity) and the McComas Street Pumping Station (0.7 mgd capacity).

The sewershed includes dense residential areas, heavily industrial areas and the downtown commercial districts. The mixture of diverse land uses and the presence of significant industrial areas make Low Level unique compared to the City's other sewersheds. The Low Level sewershed includes 13.3 square miles of contributing drainage area and two primary Interceptors (East and West) that convey flow to the Eastern Avenue Pumping Station (EAPS). All sewage pumped by the EAPS is conveyed into the main Outfall Interceptor via a 42-inch force main and a 60-inch diameter force main to a 99-inch diameter gravity outfall and then to the City's Back River WWTP.

In accordance with the CD, the following items have been completed for the Low Level Sewershed Study and Plan:

- Evaluation of the effectiveness of the construction projects completed pursuant to Paragraph 8 of the CD using rainfall and flow monitoring data, as well as the hydraulic model developed in accordance with Paragraph 12 of the CD. There were no significant construction projects defined under Paragraph 8 and the required siphon cleaning and blow-off elimination was completed with no impact to system hydraulics.

- Presentation of the results of the rainfall and flow monitoring, as well as smoke and dyed-water testing, conducted in the sewershed.

- Identification of all deficiencies discovered during the collection system inspections, which included inspection of all gravity sewers having a diameter of eight inches or greater using closed circuit television (CCTV) inspection and completed the inspection of all manholes and other appurtenances.

- Identification of all rehabilitation and other corrective actions taken, or proposed to be taken, to address the deficiencies identified during the evaluation of the sewershed.

- Description of the decision-making criteria used to select future corrective action.

- Proposal of a plan and schedule for future evaluation of the collection system within the sewershed.

- Proposal of a plan and schedule for implementing rehabilitation and other corrective actions determined necessary either to correct deficiencies identified during the collection system evaluation or to ensure operation of the collection system without causing or contributing to an SSO.

- Proposal of a plan and schedule for eliminating those physical connections between the sanitary sewer collection system and the storm water collection system.

- Determination of the range of storm events for which the collection system in its existing condition can convey peak flows without the occurrence of SSOs.

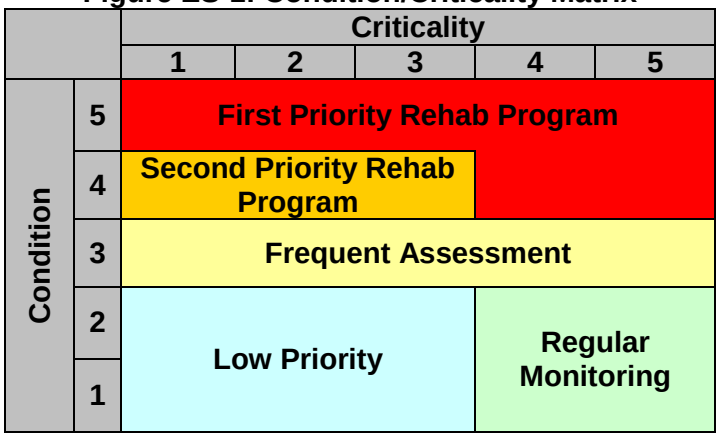
- Predictable determination of the range of storm events for which the collection system will be able to convey peak flows without the occurrence of SSOs assuming completion of the Paragraph 8 construction projects and completion of the proposed rehabilitation and other corrective action projects recommended in this Sewershed Plan.

- Certification of the Geographic Information System (GIS) described in Paragraph 14 of the CD.

As required by the CD, the Sewershed Plan identifies specific improvements or other corrective actions needed to address deficiencies and aid in reducing rainfall dependent inflow and infiltration (RDII) contributing to SSOs, address deficiencies identified during the hydraulic analyses, and address other deficiencies that contribute to SSOs.

As part of the sewershed study, the City developed a condition and criticality protocol that provides the framework for a rehabilitation strategy based on criticality (consequence of failure) and condition (probability of failure) rating of 1 through 5. Assets whose failure can impact the community or environment and whose condition is the poorest received a higher rating and will receive attention sooner. Assets that receive a lower rating will receive some level of regular monitoring but no immediate action or rehabilitation. Five levels of prioritization were developed based on the combination of condition and criticality as shown in the following matrix:

Figure ES-1: Condition/Criticality Matrix



Prioritization of asset rehabilitation projects and other corrective actions was developed with consideration that all proposed improvements required to eliminate SSOs must be completed before January 01, 2016, as stipulated by the CD. The proposed improvements include elimination of identified SSO structures, rehabilitation of "First and Second Priority Rehabilitation Program" manholes and sanitary sewers, and required hydraulic improvements. The proposed improvement projects and the estimated costs to compete these repairs are summarized in the following table:

Table ES-1: Proposed Improvement Projects Summary (cost in millions of 2008 dollars)

First and Second Priority Sewer Rehabilitation		
Rehabilitation Item	**Length/Count**	**Est. Cost**
Manhole Rehabilitation/Replacement	527 Ea.	$2.8
Cured In Place Pipe Lining	20,488 LF	$2.5
Sewer Point Repair (10' Repair)	5,200 LF	$4.1
Sewer Point Repair and Cured In Place Pipe Lining	580 LF & 7,237 LF	$0.9
	Sub-Total Estimated Cost:	*$10.3*
Sewer - Hydraulic Improvements		
Rehabilitation Item	**Length/Count**	**Est. Cost**
Heavy Sewer Cleaning	4,700 TONS	$3.3
Cured In Place Pipe Lining	54,600 LF	$6.4
Pipe Replacement	7,100 LF	$16.9
Manhole Rehabilitation/Replacement/Sealing	478 Ea.	$2.3
EAPS Water Level Drop	1 Ea.	$0.03
Locate/Inspect CNL Manholes	408 Ea.	$0.4
	Sub-Total Estimated Cost:	*$29.3*
	Total Estimated Cost:	**$39.6**

The manholes and sewers that received higher condition and criticality rating scores were recommended for inclusion on the First and Second Priority corrective action plan. These repairs included the rehabilitation or replacement of 527 manhole structures, installation of over 20,000 LF of cured-in-place (CIPP) pipe liner, approximately 5,200 LF of point repairs and the combination of point repairs and CIPP lining for approximately 7,200 LF of deteriorated sewer pipes located through the sewershed.

The recommended general hydraulic improvements include cleaning the Low Level collection system and reducing the operating water level in the Eastern Avenue Pumping Station by 2 feet. In the Gwynn's Falls Area, 77 manholes are proposed to be sealed to prevent overflowing of sewage during surcharging events and inflow of river water during river flooding events. Major pipe replacement would occur along the West Interceptor in the Gwynn's Falls Area to provide additional capacity and approximately 150 additional feet of pipe in the sewershed would be upsized to eliminate hydraulic restrictions. Approximately 800 feet of wet weather relief sewer would be installed near the East Interceptor to eliminate a local hydraulic restriction. CIPP lining and manhole rehabilitation is proposed for 26 sub-catchments in the Low Level Sewershed to reduce overall wet weather flow. It is also recommended to locate and inspect the 408 manholes that were unable to be located during the course of this Study as part of the hydraulic improvements.

It should be noted that the interrelationship between the City's sewersheds, known as boundary conditions, must be carefully considered before significant hydraulic repairs are completed. Six sewersheds are connected and hydraulically interdependent, creating "boundary" conditions that must be defined and considered for hydraulic modeling. The City has begun development of a system-wide model that will be refined and improved as the individual sewershed studies complete calibration of their respective models. This Plan provides recommended improvements that should be implemented by the City in accordance with the schedule provided. However, the Plan should not be considered final and may require amendment once the system-wide hydraulic model is completed and simulations are performed.

As required by Paragraph 9.C.xii of the CD, the City will also implement several continuous data collection programs in order to assess the effectiveness of the rehabilitation and other operation and maintenance enhancement efforts within the sewershed. These programs will be comprehensive, system-wide initiatives that will include a long-term flow monitoring plan, a sewer cleaning program, CCTV and manhole inspection programs and root and grease control programs.